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Annotated Briefing

MC 2M/ATE MOS Study: Final Report

G. Thomas Sicilia • Douglas A. Adams • David Gregory
John P. Hall, Jr. • Michael Y. Katz • Trang C. Nguyen
Hien T. Pham

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Center for Naval Analyses
4401 Ford Avenue • Alexandria, Virginia 22302-1498

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Donald J. Cymrot, Director
Workforce, Education and Training Team
Resource Analysis Division

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GT Sicilia et al.

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13. ABSTRACT (*Maximum 200 words*)

This briefing summarizes the findings and conclusions resulting from the CNA Marine Corps Microminiature/Automatic Test Equipment Military Occupational Specialty Code (2M/ATE MOS) study. The purpose of the study was to analyze a number of alternative Circuit Card Assemblies (CCA) repair strategies for MC ground systems. The alternatives considered ranged from evacuating all CCA functions to repairing them all. We also considered varying the repairer workforce composition and repair location. We found that the current repair practices, assuming that the MC assigns the number of repairer man-years we estimate are needed, saves about $75 million a year over what it would cost to evaluate and replenish failed CCAs. More money could be saved if all CCAs were repaired at a central location (Electronic Maintenance Companies). The report also finds that 2M workload does not appear to warrant a primary MOS.

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MC 2M/ATE MOS Study
Final Report

30 September 1999

This CNA Annotated Briefing (CAB) summarizes the findings and conclusions resulting from the CNA Marine Corps Microminiature/Automatic Test Equipment Military Occupational Specialty Code (2M/ATE MOS) study.

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Outline

- Executive summary of the study
- Estimating CCA densities and failures
- Costing methodology and factors
- CCA repair strategy alternatives
- Cost comparisons of strategy alternatives
- Findings and conclusions

This slide shows the organization of the briefing. Each of the topics will be discussed in turn. (CCA refers to Circuit Card Assemblies.)

Executive Summary: Study History and Purpose

- Study period: Mar 1998 - Sept 1999
- Study purpose:
  - Analyze alternative CCA repair strategies that:
    - Vary the number and types of CCAs repaired
    - Vary the repairer workforce composition and repair location
  - Develop the data needed for the analysis

The MC 2M/ATE study started in February 1998 and ran through September 1999. The purpose of the study was to articulate and analyze a number of alternative CCA repair strategies for MC ground systems. We attempted to select alternatives that would maintain or improve current service to the operation units (the customer). That is, we attempted to exclude alternatives that would degrade operational capability of the MC ground systems that contain CCAs.

The alternatives considered range from evacuating all CCA failures to repairing them all. We also considered repairer workforce options by analyzing the cost impact of using military, federal civilian, or contractor repairers. Finally, we considered the cost implications of a number of topics, including the following:

- Using a primary and secondary 2M repair MOS for military repairer workforce options
- Centralizing all CCA repairs at Electronic Maintenance Companies (ELMACOs).

An important element of the study is the design, development, and use of a "CCA repair" analysis database. In fact, the study sponsors explicitly recognized the importance and value of the assembled data for a large number of management topics that include but are not limited to the specific CCA repair issues addressed in the study.

Executive Summary: Findings*

- CCA tabulations:
  - Identified 5,680 CCA NSNs (density of 2.9M)
  - 2,432 CCA NSNs had failures in last three years
  - 29,215 CCA failures a year
- Repair status quo:
  - On average, enlisted Marines attempted 14,758 repairs a year on 1,500 CCA NSNs (3-yr history)
  - Repairs at ELMACOs and low-density (LD) units

* Numbers based on the TAMs and CCAs assigned to the 3 active force MEFs

We extracted data from the MC Applications File and used keywords developed by the Navy and DLA to identify the number and types of CCAs assigned to the three active force MEFs.* We found 5,680 different CCA National Stock Numbers (NSNs) in MC ground systems. The total density of these 5,680 CCAs across the different TAMs was also 3 million.

We assembled three years of historical data from the Marine Corps Integrated Maintenance Management System (MIMMS) and data from the Supported Activities Supply System (SASSY) to identify CCA failures. As shown on the slide, we found failures for 2,432 of the 5,680 CCA NSNs. On average, there were 29,215 failures a year in equipment at the three active duty MEFs. (Note that the focus of our effort was the peacetime active force in general and the three active duty MEFs in particular. Consistent with our tasking, we did not address the wartime force or wartime CCA repair requirements.)

We used our analysis database to develop a "status quo" alternative to capture current repair experience at the three MEFs. In addition to highlighting current experience, the status quo alternative provided a baseline for our analysis.

We found that, on average, the three MEFs attempted to repair 14,758 failures a year for 1,500 of the 2,432 CCAs with failures. We also found out that the MC currently repairs higher density CCAs (called Ground Common (GC) CCAs) at the ELMACOs. They repair low-density (LD) systems (and their CCAs) within the "LD units" to which they are assigned.

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* The data sources and database development efforts are discussed in CAB 99-89, *Marine Corps 2M/ATE MOS Study: Presentation to the Executive Steering Committee, May 1999* (July 1999).

Executive Summary: Findings (Continued)

- Annual cost estimates in $M*:
  - "Evacuate all failures" option: 167.2
  - Status quo option: 92.5
  - Fix all failures: 63.4
- Fix all CCAs at ELMACOs option saves 1% over repairs at ELMACO & LD units
- Use of fed. civilian or contractor repairers saves 2% relative to military repairers

* Assumes military repairers working at ELMACOs and LD units.

As discussed in the body of this CAB, we developed estimates of the annual costs associated with a number of CCA repair strategy alternatives. Three of the alternatives, listed on the slide with their associated costs, are:

- Evacuating (and replenishing all CCA failures) -- no attempted repairs
- The status quo discussed in the last slide
- Fixing all failed CCAs.

As shown, both of the alternatives involving the repair of CCAs have lower costs than evacuating all the CCA failures for repair or replenishment. Our estimates considered a number of cost items, including those associated with repairer manpower, repairer workstations, CCA evacuation/replenishment, and CCA float levels. (The cost factors used are discussed in the CAB with details provided in appendix A.)

We analyzed the potential cost impact of consolidating all CCA repairs at the ELMACOs (as opposed to repairing LD CCAs at LD units.) As shown, there is only a modest (about 1%) savings associated with this repair consolidation. (We assume that the positions are/will be manned at LD units with qualified part-time repairers.)

We also analyzed the potential cost impact of using federal civilian or contractor repairers on site at the ELMACOs. Assuming equal repair proficiency per man-hour, we estimate that federal civilian or contractor repairers would save about 2% relative to using military personnel to do the repairs.

Executive Summary: Bottom Line

- The status quo saves $75M a year over the "Evacuate all CCA failures" alternative
- More money could be saved if all CCAs were repaired at the ELMACO
  - $105M with military repairers
  - $106M with fed. civilian or contractor repairers
- 2M repair workload does not appear to warrant a primary MOS

The current repair practices, assuming that the MC assigns the number of repairer man-years we estimate are needed, saves about $75 million a year over what it would cost to evacuate and replenish failed CCAs. In fact, an additional $30 million could be saved, relative to the "evacuate all CCA failures" alternative, if repairs were attempted on all CCA failures and the repairs were conducted at a central location (the MEF ELMACOs).

One of the specific questions we were asked to address in the study was: should the MC establish a primary MOS for CCA repair? During the course of the study, we learned that the Comm Elec occupation field managers use a planning factor that excludes creation of a primary MOS for populations of less than 150 individuals. Our repairer man-year estimates indicate that less than half of this 150 threshold is needed. Thus, while we attempted to estimate the relative cost implications of using a primary or a secondary MOS for CCA repair, the man-year requirement estimates together with the MC planning threshold essentially answered the question posed.

Estimating CCA Densities and Annual Failures*

	Ground Common (GC) CCAs			Low Density (LD) CCAs			Combined (GC + LD) CCA Totals		
	R'ables**	C'ables**	Total	R'ables	C'ables	Total	R'ables	C'ables	Total
Number of CCA NSNs* **	2,208 (1,085)	821 (308)	3,028 (1,393)	2,038 (879)	613 (160)	2,651 (1,039)	4,246 (1,964)	1,434 (468)	5,680 (2,432)
CCA densities (M)	1.75 (1.16)	1.09 (.74)	2.84 (1.90)	.04 (.02)	.01 (.004)	.05 (.03)	1.79 (1.18)	1.10 (.75)	2.89 (1.93)
Annual CCA failures	23,127	3,005	26,132	2,836	247	3,083	25,963	3,252	29,215

* Numbers based on the peacetime forces at the 3 active force MEFs. (CCAs at the MC school at 29 Palms addressed separately.)

** R'ables = reparable CCAs and C'ables = consumable CCAs.

*** Data for CCA NSNs with failures shown in parentheses.

This slide provides more detailed data on the number of CCA NSNs, the CCA densities, and the number of failures we identified. The data are broken down to show the number of GC and LD CCAs and the number of consumable and repairable CCAs. Note that the CCA information for CCAs with failures is provided in parentheses.

Cost Estimating Methodology (Applied for Each Alternative)

- Identify
  - CCA NSNs repaired
  - CCA failures, attempted repairs, and unit costs
- Estimate
  - Repairer man-years and workstations required
  - Costs associated with CCA repair-related activities and CCA evacuation costs

This slide summarizes our approach for costing the alternative strategies.

In the first step of the methodology, we developed the list of CCAs to be repaired under each strategy alternative and the percentage of the CCA failures that will be repaired for each CCA NSN.

In the second step, we used history-based factors to compute the man-hours, the man-years, the number of workstations/repair positions, and the CCA evacuations (the CCAs that are not repaired) associated with the alternatives.

In the final step, we estimated the costs associated with each alternative. The total cost of an alternative was computed as the sum of items listed below:

- The CCA evacuation costs, which include a "service surcharge and a 35% rebate" for reparable CCAs
- Study-derived costs per man-year and workstation position
- Study-derived estimates of the costs required to adjust the CCA stockage or float levels to ensure that all the alternatives maintained the level of support provided under the status quo alternative.

Costs Factors Considered for Each Repair Strategy Alternative

- Repairer compensation
- Supervision, management, and overhead
- CCA repair parts and test workstations
- CCA evacuations
- CCA repairer training*
- Military turnover*
- CCA stockage cost

* Only estimated for military repairer options (i.e., we assumed that federal civilian and contractor repairers come to the job trained and that any turnover costs are included in their management and overhead fees).

This slide lists the costs items considered in our study. A detailed description of the cost factors is provided in appendix A.

Study Developed Cost Factors

	Military	Federal Civilian	Contractor
Cost per Man-Year	$69,512	$78,544	$90,484
Repair Man-Hrs per Man-Year	1,300	1,730	2,000
Cost per Repair Position	$15,114	$10,000	$10,000
Time per Succesful Repair	4 Hours	4 Hours	4 Hours
Repair Success Rate	82%	82%	82%
CCA Repair Parts	10% of CCA Unit Cost	10% of CCA Unit Cost	10% of CCA Unit Cost

This slide provides some of the factors discussed in appendix A and used in our study. The per-man-year costs include the "loaded" salary/compensation and overhead costs. The contractor costs also include the government contract management costs. The military costs include the estimated turnover cost to account for the fact that the military starts with untrained recruits and has significant turnover in its workforce.

As shown, we used the same repair productivity factors (hours per repair and repair success rate) for all repairers. These data are consistent with MC CCA repair data collected during the study, with Navy CCA repair data, and with numerous discussions with CCA repair subject matter experts (SMEs).

Since the number of man-hours needed to accomplish the repairs does not vary by type of worker, the total man-hours required for the CCA repair functions is the same for military, federal civilian, and contractor repairers. However, the number of repairer man-hours per man-year (and therefore the number of man-years required) does vary by repairer type. The military factor reflects the fact that the military has other military duties to perform beyond CCA repair. This factor is consistent with OPNAV INST 1000.16H and reflects discussion with MC CCA repair SMEs. The federal civilian factor comes from the same OPNAV instruction and assumes that the federal civilians spend all of their productive time doing 2M repair. The contractor-hours/man-year factor is based on a 40-hour week for 50 weeks and is consistent with discussions with SMEs from contracting offices, the MC, and the private sector.

The CCA repair parts cost estimate was based on discussions with CCA repair SMEs.

Current MC CCA Repair Strategy: the Status Quo Alternative

- Enlisted Marines attempt to repair CCA failures for subset of CCA NSNs
  - Attempted repairs documented for 1,500 of the 2,432 CCA NSNs with failures over a 3-year history
  - Repairs attempted for only 56% of the failures identified for the 1,500 CCA NSNs
  - In general, repairs focused on Comm Elec equipment
- Repair locations:
  - GC CCAs repaired at ELMACOs
  - LD CCAs repaired at low-density units

This slide summarizes the current CCA repair practices and experience for the MC ground systems.

Defining Alternatives to the Status Quo

Status Quo:		**Changes Considered:**		**Naming Convention:**
• Repair a subset of CCA failures	→	Repair all (no) failures for selected NSNs	→	Alternatives
• Repairs @ ELMACO and LD units	→	All repairs @ ELMACO	↘	Options within alternatives
• Enlisted repairers	→	Federal civilian & contractor repairers	↗	

This slides depicts the changes we considered in developing the strategy alternatives to the status quo. It also highlights some of the conventions we used in identifying and naming the alternatives. As indicated, the number of CCA NSNs repaired defines the alternative. The workforce and repair location variation are applied as options or subalternatives for each alternative considered.

Repair Strategy Alternatives

- Three "boundary" alternatives
  - Evacuate all failed CCAs -- no repairs
  - Status quo -- some repairs for 1,500 CCAs
  - Repair all failed CCAs
- Three "excursion" alternatives*
  - Repair CCAs in Comm Elec TAMs
  - Repair CCAs in at least one Comm Elec TAM
  - Repair CCAs in at least one MCGERR TAM

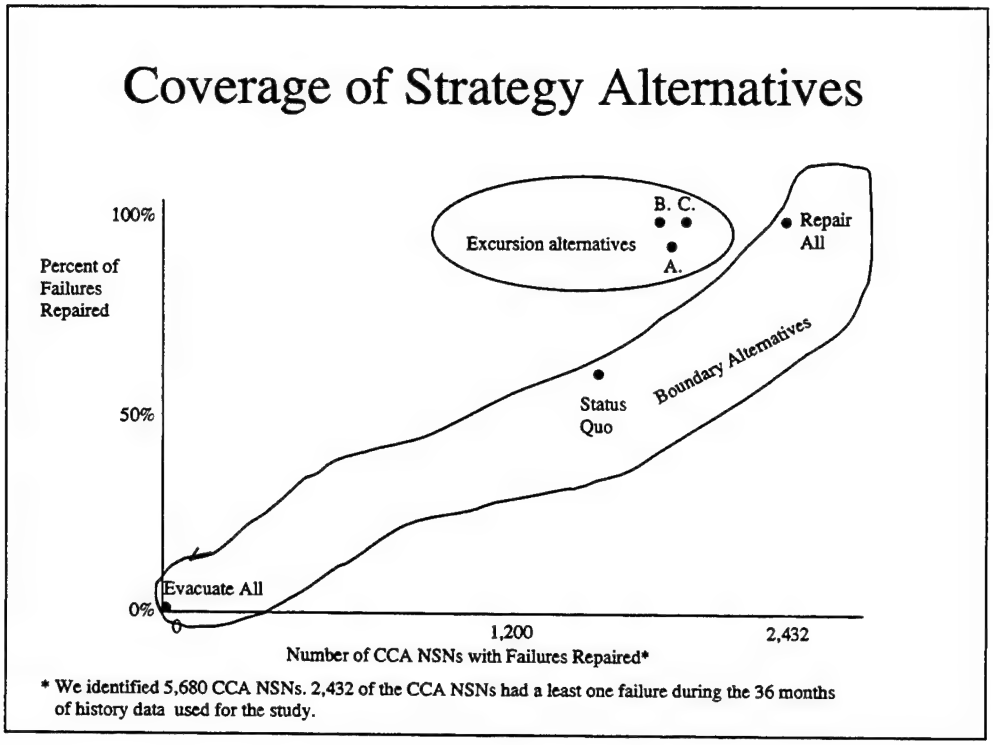
*Referred to as alternatives A, B, and C in the next slide.

This slide depicts the alternatives analyzed in our study. As shown, there are three "boundary alternatives" that include the status quo, evacuating all failures, and repairing all failures. There also are "excursion alternatives."

The first excursion alternative calls for repairing all CCAs when they are in Comm Elec TAMs. As discussed in CAB 99-89, many of the CCAs are in more than one TAM and often the TAMs are in different commodities. Under this alternative, the MC would only fix CCAs removed from Comm Elec TAMs and would not fix the same CCA if it came from a non-Comm Elec TAM. This alternative is consistent with the current maintenance organization and is a natural extension of the status quo alternative.

The second excursion alternative would repair all CCAs contained in a Comm Elec TAM but would repair this CCA regardless of the TAM from which it came. This alternative is consistent with the current focus on Comm Elec TAMs but capitalizes on the experience and expertise gained on the CCAs covered by the alternative.

The third excursion alternative focuses on CCAs contained in mission essential (MCGERR) TAMs. Consistent with the logic used for the second excursion alternative, this alternative would repair all CCAs contained in MC Ground Equipment Resource Reporting (MCGERR) TAMs but would repair these CCAs whenever they failed regardless of the TAM from which they came.



This slide illustrates the coverage of the alternatives in terms of CCA failures. The x-axis shows the number of CCAs covered by the alternative, and the y-axis depicts the aggregate percentage of the number of CCA failures that will be repaired.

CCA Coverage by Alternative

	NSNs Covered*	CCA Density*	Failures Covered	Attempted Repairs
Boundary Alternatives				
– Repair none	2,432	1.9M	29,215	0
– Status quo	1,500	.9M	26,362	14,758
– Repair all	2,432	1.9M	29,215	29,215
Excursion Alternatives				
– All Comm Elec	1,930	1.3M	22,750	22,750
– In at least 1 Comm Elec	1,930	1.8M	25,418	25,418
– In at least 1 MCGERR	2,082	1.8M	24,816	24,816

* Refers to CCA NSNs with failures.

This slide displays in tabular fashion the same data as the previous slide .

Repairer Workforce and Repair Location Options Addressed

- Repair location options:
  - All repairs at ELMACO
  - LD repairs at LD unit, GC repairs at ELMACO
- Repairer workforce options:
  - Military, federal civilian, or contractors at ELMACOs
  - Only military repairers considered for repairs at LD units

This slide shows the workforce and repair location options considered for all of the alternatives except the status quo alternative, which involves military repairers fixing GC CCAs at ELMACOs and LD CCAs in LD units.

As noted in the slide, we assume that federal civilian and contractor repairers will be located at ELMACOs because of the often small workload associated with the LD units. Thus, we assume that all repairs done in a LD unit will be accomplished by military repairers.

Annual Cost of Repair Strategy Alternatives in $M*

	CCAs repaired:	Military	Fed Civ	Contractor
Boundary Alts	None	167.2	167.2	167.2
	Status quo: percent of selected NSNs	92.5 *(N/A)*	N/A	N/A
	All	63.4 *(62.7)*	62.1 *(61.3)*	62.1 *(61.2)*
Excursion Alts	All CCA in Comm Elec TAMs	76.3 *(75.6)*	75.3 *(74.4)*	75.3 *(74.3)*
	All CCAs in at least one Comm Elec TAM	69.7 *(69.0)*	68.7 *(67.8)*	68.7 *(67.7)*
	All CCAs in at least one MCGERR TAM	75.5 *(74.8)*	74.4 *(73.5)*	74.3 *(73.5)*

* Table entries reflect the cost for GC CCA repair @ ELMACO and LD CCA repair @ LD units, all repairs @ ELMACOs option in parentheses.

This slide shows the cost of the six alternatives for the military repairers. (Detailed data for all the alternatives and options are provided in appendix B.)

The table entries depict the case where GC CCAs are repaired at the MEF ELMACOs and LD CCAs are repaired at the low-density units. We assume that LD CCA repairs at LD units are performed by military repairers. The case where all repairs are accomplished at the ELMACOS is provided in parentheses.

As shown, all alternatives that include CCA repairs (the second through the sixth) are less costly than the "evacuate all CCA failures" alternative. In fact, even the status quo alternative, which repairs only 56% of the failures for 1,500 CCAs, saves almost 65 million relative to the evacuate all failures alternative.

In general, costs decrease as the number of CCAs repaired increases, and federal civilian and contractor repairer workforce options are slightly less expensive than those involving military repairers. (This is influenced by our assumption that all the workforces have the same repair productivity per man-hour. The final CNA research memorandum for this study will explore variation to this assumption.) However, using military repairers is less costly than evacuating CCAs, and use of military repairers ensures that the repairs can be accomplished in wartime and conflict situations.

Finally, performing all repairs at the ELMACO required less workstations and is slightly less expensive than repairing CCAs at the ELMACO and LD units.

This slides lists three side analyses we were asked to investigate. Each of these will be discussed in turn.

Primary vs. Secondary 2M Repair MOS

- Estimated a lower 2M repair training cost for primary vs. secondary MOS
  - More time during the career doing 2M repairs
  - Estimated annual cost is $2,263 vs. $5,114
- Items not quantified
  - Possible differences in repair skills and proficiency
  - Cost to mange a primary vs. a secondary MOS

One of the questions that led to this study concerned whether the MC should create a primary MOS for 2M repair. In the course of the study, we learned that the MC Comm Elec occupational managers have experience-based planning factors that require a population of at least 150 billets for a primary MOS. As shown in the detailed data in appendix B, the largest military requirement called for only 77 military man-years and 127 workstation positions. Therefore, it does not appear that there is enough workload to warrant a primary MOS.

However, we did explore the cost implications of primary versus a secondary MOS. As shown, we estimate that 2M training would less for a primary than for a secondary MOS.* There are two reasons for the cost differences (discussed in more detail in appendix A):

- We assume that a person with a secondary MOS will spend 2 years doing CCA repairs, so the annual cost is one half of the full costs. We assume a person with a primary MOS would spend 4 years doing CCA repair so the annual cost would be a quarter of the full cost.
- We assume that a secondary MOS 2M trainee would be an E4 and a primary MOS 2M trainee would be an E2. (A person with a primary MOS would receive the training in the initial training pipeline)

As noted, there were several factors we did not pursue that could affect the cost of a primary versus secondary MOS.

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* We assumed a secondary MOS in the costing estimates discussed in the previous slides.

Varying the Number of CCA NSNs Repaired Under the Alternatives

- Refine set of CCAs to be repaired:
  - Repair all NSNs covered by the alternative (base case)
  - Repair NSNs with a unit cost of $500 or more
  - Repair NSNs with at least 3 attempted repairs a year
- Analysis focus: military repairer options
  - Results also track for federal civilian and contractor repairer workforces

The second side analysis concerns a refinement of the six alternatives already discussed. In effect, we explored two variations to the set of CCAs discussed in the set of alternatives. As already stated, the alternatives assume that all CCAs meeting specified criteria would be repaired. In this side analysis, we refined the set of CCAs repaired to:

- Exclude low-cost CCAs (those with a unit cost of less than $500)
- Exclude those CCAs for which we found no repair experience (we excluded CCAs with less than 3 repairs a year based on the three years of history data [one per MEF per per year]).

The results of this analysis are summarized on the following slide.

Cost Implications of Varying CCAs Repaired in the Alternatives* - $M

	CCAs repaired:	All CCAs	> 2 Repairs per Year**	Unit Cost > $500 **
Boundary Alts	None	167.2	167.2	167.2
	Status quo: percent of selected NSNs	N/A	N/A	N/A
	All	63.4 (62.7)	76.4 (75.8)	63.1 (62.4)
Excursion Alts	All CCAs in Comm Elec TAMs	76.3 (75.6)	86.4 (85.8)	75.9 (75.4)
	All CCAs in at least one Comm Elec TAM	69.7 (69.0)	80.4 (79.8)	69.6 (68.8)
	All CCAs in at least one MCGERR TAM	75.5 (74.8)	85.2 (84.6)	75.1 (74.4)

* For military repairer cases, Table entries reflect the cost for GCCCA repair @ ELMACO and LD CCA repair @ LD units, all repairs @ ELMACOs option in parentheses.

This slide shows the cost implications of refining the list of CCAs repaired under each alternative based on recent repair experience (3 or more repairs a year where, as already noted, this level was selected to approximate one repair for the CCA per year per MEF) and CCA unit cost (unit cost of $500 selected for our analysis). This slide focuses on the military repairer scenarios, but the full set of data for all the repairer workforce options is provided in appendix B.

As indicated in the slide, the experience-based refinement increases the cost for all of the alternatives. This is likely related to the fact that current repair practices do not focus on the more costly CCAs, which, if excluded from the alternative, must be evacuated when they fail.

Finally, the slide shows that restricting repairs to CCAs with a unit cost of $500 or more does save money. This makes sense because a military repairer "costs" about $50 per man-hour (annual man-year cost divided by man-hours per man-year), and we assume it takes 4 hours to repair a CCA. Therefore, with our assumptions, it is more cost effective (based solely on manpower-based costs) not to repair CCAs with a unit cost of less than $200. Of course, part of this finding is tied to our time-to-repair assumptions; if it takes less time to fix a lower cost (and likely simpler) CCA, the costs estimate would decrease for this option.

CCA Densities, Failures, and Repair Workload at MC Schools

- 3,500 CCA NSNs at MC School
  - CCA density is 90,399
- 1,593 CCA failures (using MEF failure rates)
- Number of required CCA repairer man-years/workstations
  - 4 military repairers
  - 3 federal civilian or contractor repairers

We were asked by the study sponsor to consider the CCAs and CCA repair requirements for the MC school at 29 Palms. We were able to identify the number of CCA NSNs at the school and their densities by using our Application File and LMIS data extracts. However, we had no school-based failure or repair data. To work around these deficiencies, we used the CCA failure rate computed for the MEFs by CCA and applied the rate to the school CCA densities. We then assumed that the school would repair all of the CCA failures.

The results of this computation are shown on the slide where 4 military or 3 federal civilian or contractor repairer man-years would be required per year. In addition, since we assumed that the repairs would take place at a central location at the school, the number of workstation positions would be the same as the man-years.

Appendix A: Costing Factors and Estimating Methodology

Section 1: Factors of the Cost per Repair Man-Year

Section 2: Factors of the Cost per 2M Repair Workstation/Position

Section 3: CCA Evacuation/Replenishment and Repair Parts Costing

Section 4: Annualized CCA Float Cost

Section 1: Factors of the Cost per Repair Man-Year

Cost Summary	Military	Fed. Civilian	Contractor
Direct labor	$32,600	$58,545	$59,634
First-line supervision	$2,582	$4,645	$4,882
Indirect labor	$4,988	$4,988	$4,988
BOS and RPM	$5,250 $115	$5,250 $115	$5,250 $115
Govt.'s facility G&A	$5,011	$5,011	$5,011
Govt. contract mgt.	N/A	N/A	$6,186
Contractor G&A	N/A	N/A	$4,418
Personnel Turnover	$18,966	N/A	N/A
Total cost/MY	$69,512	$78,544	$90,484

Cost Worksheets (All costs are in FY 2000 dollars):

1. The following are the annual **direct pay and allowances** rates to be used for repair personnel in the study.

Military	Civilian	Contractor
E-4 $32,600	WG-11, step 2 $58,545	Jr. Tech. $59,634

The annual direct pay and allowance rate used for the military grade E-4 comes from the FY 2000 Military Composite Standard Pay and Reimbursement Rates for the U.S. Marine Corps, as shown on the OSD Comptroller web site. For an E-4 the annual pay and allowances total $32,600. The salary noted includes basic pay, retirement accrual, housing allowance, subsistence, special pay, PCS, and miscellaneous expenses.

The civilian pay rate reflects the pay of a step-2 WG-11 worker in the Atlanta, Georgia, wage area.[1] We started with the 1999 pay scale rate of $19.68 per labor hour published by OPM on their web site and added in the currently projected pay raise for government civil service employees of 4.8 percent to reach $20.62 per hour in FY 2000. Next we multiplied by 2,080 hours to reach a FY 2000 annual salary costs of $42,890. Finally, we added in a 36.5 percent allowance to cover fringe benefits and unfunded civilian retirement costs. This factor we obtained from the OSD Comptroller's web site, under the listing for Civilian Personnel Fringe Benefits, Fiscal Year 2000. The final result is an annual salary of $58,545.

The pay rate for a contract worker (junior technician) is based on data provided by a NAVSEA contracting officer, a Fort Belvoir Army contracting officer, and other input sources noted below. We obtained the direct labor hourly rate from NAVSEA, quoted at $16.86 per hour in FY 1999 for a junior technician. We added 3 percent to this to reach FY 2000, bringing us to $17.37 per hour. Next we added 50 percent ($8.69 per hour) to reflect additional costs a contractor would charge for on-site labor. Our input from the Army contracting officer indicates that this covers health and life insurance, FICA and state unemployment taxes, holidays, vacations, uniform service, and the like. The 50-percent factor also coincides with comments from OSD Comptroller personnel during discussions with them.[2] The Alexandria office of DCAA indicated that the contractor's fee should be in the range of 10 – 15 percent. We chose 10 percent as our fee rate because of the competition likely to be involved in this type of contract. The final FY 2000 hourly rate for the repairman computed to $28.67 or $59,634 annually.[3]

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[1] Wage rates in areas other than Atlanta could differ significantly from the value shown (probably lower).

[2] Under Secretary of Defense (Comptroller/Chf. Budget Officer); Dep. Comptroller (Prog./Budget), Revolving Funds Branch.

[3] At this point, we do not have a fully burdened labor rate. This occurs when the contractor's G&A charges are added (see paragraph 7).

2. The following is the annual cost of **first-line supervision** for each repairman.

Military	Civilian	Contractor
E-5 $2,582	WL-11, step 4 $4,645	Sr. Tech. $4,882

The E-5 supervisor's pay and allowance is based on one E-5 supervising 15 military repairmen. The FY 2000 direct pay and allowance for a full-time E-5 would be $38,725, using the same data source as for the E-4 in the previous section. The E-5's cost however, is prorated over 15 E-4 repairmen, resulting in supervision costs of $2,827 per repairman per year.

For the civilian supervisor we assumed the same 15 to 1 ratio of repairmen to supervisors. Further, we assume that by the time a WG-11 repairman was promoted to supervisor his seniority would place him in the step-4 pay category ($23.42 per hour). Following the same rationale as before, the annual cost of a WL-11 step-4 would compute to $24.54 x 2,080 hours, plus 36.5 percent for fringe benefits and unfunded retirement costs, which equals $69,674 annually. Again, prorating this over 15 repairmen gives us $4,645 per repairman per year for first line supervision.

From the same input sources as the junior technician, a full-time senior technician costs $73,237 annually in FY 2000. We started with a rate of $20.72 per hour in FY 1999 and escalated this to $21.34 per hour in FY 2000. Adding in the 50-percent factor for fringes and a 10-percent fee brings the total to $35.21 per hour (or $73,237 annually). Here we also assumed a supervisor ratio of 15 to 1, giving a prorated annual cost for supervision of $4,882 per repairman per year.

3. The cost of **other indirect labor** (exclusive of supervision) is as follows.

Military	Civilian	Contractor
$4,988	$4,988	$4,988

We obtained this cost from data in a CNA Research Memorandum (CRM 93-116) on intermediate versus depot-level repair costs.[4] The CRM defines other (non-supervisory) indirect labor as personnel involved in production control, QA, calibration, shop supply operations, and administration of selected maintenance offices. In the CRM, the computed value for this charge was 15.3 percent of the direct labor cost of the repairman. Because the indirect support costs are external to the work center which we are analyzing and will not change no matter which option is used, we chose to use the military cost for both civilian and contractor management.

[4] CNA Research Memorandum 93-116, *Intermediate versus Depot-Level Repair Costs: A Methodology for Estimating Intermediate-Level Costs*, by Peter W. Czapor, August 1993.

4. The following are the costs of **base operating support (BOS)** and **real property management** to be used.

Military	Civilian	Contractor
BOS $5,250	BOS $5,250	BOS $5,250
RPM $115	RPM $115	RPM $115

CRM 93-116 used a method for computing BOS and real property mgt. (RPM) that we have adopted for this study. Basically, the CRM proposed prorating the total service budget for the two categories over the service's manpower end strength. The Marine Corps FY 2000/2001 O&M Budget Submit projects total BOS costs to be $847.333 million in FY 2000 against an end strength of 172,148 Marines. The RPM budget request was $18.557 million. This computes to $4,922 per Marine for BOS and $108 each for RPM. To this we add the allowance for the supervisor (one-fifteenth), raising the final numbers to $5,250 for BOS and $115 for RPM. As above, we consider these costs to be constants, regardless of who operates the facilities.

5. The following are the **Government's facilities G&A** costs to be used in the study.

Military	Civilian	Contractor
$5,011	$5,011	$5,011

The G&A rate associated with the government's ownership of the facilities comes from CRM 93-116. For a shore-based military operated intermediate-level repair facility, the CRM computed G&A to be 30.8 percent of the direct labor costs. However, this percentage also includes BOS and RPM costs. To derive a G&A rate exclusive of these, we computed 30.8 percent of the direct labor costs for a military operated facility ($32,600 x .308 = $10,041) and then removed the corresponding estimated costs for BOS and RPM ($4,922 and $108 respectively). The final result is a G&A amount of $5,011 versus a direct labor charge of $32,600 for the repairman.[5] Because of the nature of these G&A costs, we held the amount constant regardless of who did the repair work.

6. The following are the **government contract management oversight** costs to be used in the study.

Military	Civilian	Contractor
N/A	N/A	$6,186

Costs to the government to oversee a contractor's work do not apply to facilities operated by the military and government civilians, but they are a cost of the contractor-run

[5] This G&A rate is separate and distinct from what the contractor will charge the government to internally administer the people hired to work the facility as on-site company personnel. For the contractor G&A rate, refer to paragraph 7.

operation. We looked at data in NCCA's Standard Cost Factors Handbook and set this to be 8.4 percent of the contractor's total labor ($73,640 x .084 = $6,186). We derived the factor by comparing four data sets in the NCCA Standard Cost Factors Handbook (fighter aircraft EMD, electronics procurement, and missile EMD and procurement). For these data sets, the cost for government oversight was 11.2, 5.6, 8.3, and 8.4 percent of the contractor's costs. The average, 8.4 percent, was the factor chosen.

7. The following is the **contractor G&A surcharge** fee to be used in the study.

Military	Civilian	Contractor
N/A	N/A	$4,418

This cost applies only to the contractor-operated facility. It is the G&A cost the contractor needs to recoup his costs for administrating his personnel even though they are on-site at the government's facilities. It is separate and distinct from the G&A costs the government incurs to oversee (or operate) the facility. We have not included this cost in any of the cost items covered so far. We set this to be one-half of the nominal commercial G&A rate of 12 percent (i.e., 6 percent of all labor costs). Our decision to cut this rate in half reflects an anticipated low level of company involvement in administering the contract. The contractor G&A computes to be $73,640 x .06 = $4,418. The nominal G&A rate of 12 percent we state comes from recent CNA cost efforts regarding image-guided bombs (CRM 98-11).[6] In developing the costs for the CRM, we received a G&A factor of 12 percent from the China Lake research laboratory to use as representative of the electronics industry.

8. Annual Military Turnover Cost per 2M Repair Man-year

Current Situation and Cost Factors:

- The MC currently programs 65 school graduates to maintain the MOS 2881 strength of 215. We assume this ratio of 65 graduates and 215 end strength holds for people who perform 2M repairs.
- We assume a 17% attrition rate between entrance in the MC and attaining a Comm Elec-oriented MOS. (An ongoing CNA study that is addressing attrition rates for the MC basic electronics school found that the attrition rate, from boot camp entrance to an electronic MOS attainment, ranged from 17% to 20% depending on MOS.)
- Because we assume a 17% attrition rate, we compute that 78.3 accessions are needed a year to maintain the strength of 215. (65/.83 = 78.3).
- Based on results from the CNA MC basics electronics training study, we assume that it takes 13 months to progress from entrance in the MC to attaining an electronic-oriented MOS.

[6] CNA Research Memorandum 98-11, *Viability of Image-Guided Bombs: Final Report (U)*, Secret, by Douglas Adams et al., 1998.

- We compute the number of trainee man-years per accession to be: [(1 + .83)/2] x 13/12 = .991. The accessions per position is 78.3/215 = .364 so the man-years per position is = .991 x .364 = .361
- We assume that the average trainee is an E2 with a composite FY 2000 pay rate of $25,950.
- We assume that training support and infrastructure costs can be estimated at two times the student basic pay amounts. This factor was derived from a previous CNA study: *Average Cost of Training for First –Term Marines,* CRM 90-238/April 1991. The following tables from the study depict the results of this study for two sites. (This ratio of course costs to student pay will also be used in a ongoing CNA Study study's final report titled: Final Report of Officer and Enlisted Accession and Retention Issues Study. The final report is due Nov. 1999.)

RATIO OF COURSE COSTS TO STUDENT PAY (AS A %)
BASIC & COMBAT TRAINING AT CAMP LEJEUNE

	O&M	INDIR.	INSTRU'TR	SUB-TOTAL	STU.PAY	TOTAL
BASIC	2,340	8,637	3,570	14,547	3,343	17,890
COMBAT	603	3,701	547	4,851	1,294	6,145
ELEX	1,038	483	3,545	5,066	6,463	11,529
	3,981	12,821	7,662	24,464	11,100	35,564
	SUBTOTAL/STU PAY (AS A %)			220.40		

RATIO OF COURSE COSTS TO STUDENT PAY (AS A %)
BASIC & COMBAT TRAINING AT CAMP PENDLETON

	O&M	INDIR.	INSTRU'TR	SUB-TOTAL	STU.PAY	TOTAL
BASIC	2,340	8,637	15	10,992	3,343	14,335
COMBAT	603	3,701	782	5,086	1,294	6,380
ELEX	1,038	483	3,545	5,066	6,463	11,529
	3,981	12,821	4,342	21,144	11,100	32,244
	SUBTOTAL/STU PAY (AS A %)			190.49		

- The annual FY 2000 basic pay for an E2 is $13,335.

Cost Estimates:

- Trainee pay per 2M repair man-year = trainee man-years x trainee pay = .361 x \$25,950 = \$9,368.
- Training support and infrastructure costs per 2M repair man-year = 2 x trainee base pay x trainee man-years = 2 x \$13,335 x .361 = \$9,628.
- Total costs 2M repair man-year = \$9,368 + \$9,628 = \$18,996.

Section 2: Factors of the Cost per 2M Repair Workstation/ Position

Cost Summary:

Cost Item	Military	Federal Civilian	Contractor
2M Training* (Secondary MOS)	$5,114	$0	$0
Testers and Tester Maint.	$10,000	$10,000	$10,000
Total*	$15,114	$10,000	$10,000

- 2M training is estimated to be $2,263 a year for a primary MOS case.

Cost Worksheets:

1. Annual Military 2M Training Cost per 2M Repair Position Cost

Current Situation and Cost Factors:

- The Marines teach ten 2M-repair classes a year with 14 students per class. There is very little attrition in the course. We assume no attrition for the course.
- The classes are 9 weeks long so we assume that a trainee spends 9/52 = .173 man-years in training.
- We assume that a person with 2M repair as a secondary MOS will spend 2 years doing 2M repairs (essentially one tour). Thus, the annualized 2M trainee man-years for those with a secondary MOS are .173/2 or .0865.
- We assume that a person with 2M repair as a primary MOS will spend 4 years (two tours) doing 2M repairs. Thus, the annualized 2M trainee man-years for those with a primary MOS are .173/4 or .043.
- The typical 2M repair class student is an E4 when the 2M repair position is filled by someone who has a 2M repair secondary MOS and an E2 when the 2M repair billet is manned by someone with 2M repair as a primary MOS.
- The composite FY 2000 pay rate for a Marine E2 is $25,950. The E4 composite rate is $32,600.
- We assume that training support and infrastructure costs can be estimated at two times the student basic pay amounts (discussed in Section 1.8). The annual FY 2000 basic pay for an E2 and E4 are $13,335 and $26,517, respectively.

Cost Estimates (Secondary MOS Case)

- Student pay: E4 pay for .0865 man-years = $32,600 x .0865 = $2,820
- Training support and infrastructure: 2 x E4 base pay for training period = 2 x $26,517 x .0865 = $2,294.
- Total cost: $2,820 + $2,294 = $5,114.

Cost Estimates (Primary MOS Case)

- Student pay: E2 pay for .043 man-years = $25,950 x .043 = $1,116.
- Training support and infrastructure: 2 x E2 base pay for training period = 2 x $13,335 x .043 = $1,147.
- Total cost: $1,116 + $1,147 = $2,263 .

2. CCA Tester and Tester Maintenance Cost Worksheet

- The Marine Corps uses two pieces of support equipment to perform repair on electronic circuit card assemblies (CCAs):
  - USM-646 (Huntron Tracker)–a general-purpose test set designed to troubleshoot CCAs down to the piece part level. This system costs $26,000 to procure from the FEDLOG catalogue.
  - Maintenance Kit Electronic Equipment–This kit provides tools and equipment required to perform micro-miniature repair and soldering to electronic circuit cards and assemblies. This kit costs $8,000 to procure.

- The Marine Corps Systems Command procures both these units as one system to repair CCAs at the local level.

- The current inventory objective is 300 systems for 100 sites, of which 50 systems will be assigned to each of three Marine Expeditionary forces.

- There is negligible maintenance cost per site.

- The Marine Corps System Command, TMDE Program Manager, provides $300,000 annually to the Naval Undersea Warfare Center to provide program support.

- Since there are already enough test sets at the MEFs to meet the demand, we only apply the annual $10,000 program support costs ($300,000/300 test sets).

Section 3: CCA Evacuation/Replenishment and Repair Parts Costing

1. CCA Evacuation/Replenishment Costing:

   - Reparable CCAs

     – Cost = (1 - rebate) x (CCA unit cost) x [(CCA failures - attempted repairs) + (unsuccessful attempted repairs)]

       = (.65) x (CCA unit cost) x [(CCA failures - attempted repairs) + (.18) x (attempted repairs)].

   - Consumable CCAs

     – Cost = (CCA unit cost) x [(CCA failures - attempted repairs) + (unsuccessful attempted repairs)]

       = (CCA unit cost) x [(CCA failures - attempted repairs) + (.18) x (attempted repairs)].

2. CCA Repair Parts Costing:

   - For each CCA

     – Cost = (successful repairs) x (10%)* x (CCA unit cost)

       = (.82) x (attempted repairs) x (.1) x (CCA unit cost).

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* 10% factor selected based on discussions with MC and Navy CCA repair subject matter experts.

Section 4: Annualized CCA Float Cost

Background:

The purpose for this float-based cost analysis was to investigate the CCA float levels (and their annualized costs) associated with the different repair strategy alternatives considered in our study. The rationale for the analysis is tied to our goal to ensure that each of the alternatives considered maintains or improves the CCA maintenance service currently provided.

It is generally recognized that repairing a CCA on site typically results in a lower CCA recycle time (the time required to repair or replace a failed CCA) than the recycle time of evacuating and replacing the CCA. In fact, one reason for fixing CCAs is to reduce the CCA recycle time, which is a major factor in determining the required float level. Therefore, it follows that the size (and costs) of the float should be influenced by the number of CCAs repaired locally.

The analysis described in this discussion attempts to quantify this float-CCA repair relation. We accomplished this by estimating the float levels that would be required to ensure that each of the alternatives maintains the support provided under the current situation (the status quo alternative).

Data and assumptions:

- We assembled three years of history data. Based on these data, we estimated that the MC annually attempts to repair 56% of the CCA failures that occur for 1,500 different CCA NSNs. No repairs are attempted on the remaining 932 CCA NSNs that had failures.

- The MC has a supply or float of extra CCAs for 2,200 different CCA NSNs. We reviewed and edited this list of CCAs to eliminate data errors and inconsistencies. As a result, we focused our float analysis on 1,086 CCAs with floats.

  - 357 of the CCAs with floats had no repairs attempted reported in MIMMS

  - 729 of the CCAs with floats had repairs attempted reported in MIMMS.

Computations and Calculations:

- The historical MIMMS CCA repair data can be used to compute the repair-based recycle time for successful CCA repairs using the "time out of shop" and the "time in shop" data fields. We made this computation on a CCA-by-CCA basis when the history data listed successful repairs. For some CCAs, there were no successful repairs reported in the MIMMS history data, so we had to estimate what a repair-based recycle would be. In these cases, we used the

average repair-based recycle time (32.8 days) computed over all the CCAs with successful repairs.

- We also needed a recycle time estimate for situations where the failed CCA was evacuated and replenished. Based on discussions with MC maintenance SMEs, we learned that evacuation and replenishment of a failed CCA typically take 60-180 days. We selected a 60-day evacuation-based recycle time for this analysis.

- We computed the current recycle time for each CCA with a float using the following formula:

  [(Number of attempted repairs x "MIMMS" recycle time) + ({Number of CCA failures - number of attempted repairs}) x 60 days] / Number of failures.

  Note: when every CCA failure is repaired, the current recycle time is equal to the MIMMS recycle time. When there are no repairs, the current recycle time is assumed to be 60.

- We estimated the Float level for the situation where repairs are attempted for all failures of a CCA the "Repair All Failures Float Level" via the relationship:

$$\frac{\text{Current Float Level}}{\text{Current Recycle Time}} = \frac{\text{Repair All Failures Float Level}}{\text{MIMMS Recycle time}}$$

- Similarly, we estimated the Float level for the situation where no repairs are attempted for failures of a CCA, the "No Repair Float Level" via the relationship:

$$\frac{\text{Current Float Level}}{\text{Current Recycle Time}} = \frac{\text{No Repair Float Level}}{\text{60 days}}$$

- We computed the total size and cost of the float associated with each repair strategy alternative by observing which CCAs are repaired and which are evacuated under each alternative. We then multiplied the appropriate float level by the unit cost for each CCA and summed them over all the CCAs (For the status quo alternative we used the current float levels and their unit costs.)

- To develop an annualized cost, we computed the average remaining service life for each CCA and spread the total float cost discussed above over this period. We computed the average remaining service life for each CCA by

  - Identifying the set of TAMs that contain the CCA and the density of each of these TAMs

- Identifying the service life of the TAM by noting the "out of service year" listed in LMIS for the TAM

- Developing the CCA remaining service life based on the density and remaining service of the associated TAMs.

Appendix B: Cost Computations

Section 1: Cost Summaries

Section 2: Repairer Man-hour, Man-year, and Workstation/Position Computations

Section 3: CCA NSNs, CCA Densities, and CCA Failures Computations

APPENDIX B: COST COMPUTATIONS
SECTION 1: COST SUMMARIES

Alternative 1: Evacuate All CCAs

(All CCAs)

	At ELMACO			At ELMACO & LD Unit		
Cost Item	Military	Fed Civilian	Contractor	Military	Fed Civilian	Contractor
Man year	0	0	0	0	0	0
Position	0	0	0	0	0	0
Evacuation	140,179,960	140,179,960	140,179,960	140,179,960	140,179,960	140,179,960
Float	27,057,247	27,057,247	27,057,247	27,057,247	27,057,247	27,057,247
Total	167,237,207	167,237,207	167,237,207	167,237,207	167,237,207	167,237,207

(CCAs with greater than 2 Attempted Repairs)

	At ELMACO			At ELMACO & LD Unit		
Cost Item	Military	Fed Civilian	Contractor	Military	Fed Civilian	Contractor
Man year	N/A	N/A	N/A	N/A	N/A	N/A
Position	N/A	N/A	N/A	N/A	N/A	N/A
Evacuation	N/A	N/A	N/A	N/A	N/A	N/A
Float	N/A	N/A	N/A	N/A	N/A	N/A
Total	N/A	N/A	N/A	N/A	N/A	N/A

(CCAs with Unit Cost greater than $500)

	At ELMACO			At ELMACO & LD Unit		
Cost Item	Military	Fed Civilian	Contractor	Military	Fed Civilian	Contractor
Man year	N/A	N/A	N/A	N/A	N/A	N/A
Position	N/A	N/A	N/A	N/A	N/A	N/A
Evacuation	N/A	N/A	N/A	N/A	N/A	N/A
Float	N/A	N/A	N/A	N/A	N/A	N/A
Total	N/A	N/A	N/A	N/A	N/A	N/A

Alternative 2: Status Quo

(All CCAs)

	At ELMACO			At ELMACO & LD Unit		
Cost Item	Military	Fed Civilian	Contractor	Military	Fed Civilian	Contractor
Man year	N/A	N/A	N/A	2,710,968	N/A	N/A
Position	N/A	N/A	N/A	1,163,778	N/A	N/A
Evacuation	N/A	N/A	N/A	88,649,921	N/A	N/A
Float	N/A	N/A	N/A	18,934,808	N/A	N/A
Total	N/A	N/A	N/A	111,459,475	N/A	N/A

(CCAs with greater than 2 Attempted Repairs)

	At ELMACO			At ELMACO & LD Unit		
Cost Item	Military	Fed Civilian	Contractor	Military	Fed Civilian	Contractor
Man year	N/A	N/A	N/A	N/A	N/A	N/A
Position	N/A	N/A	N/A	N/A	N/A	N/A
Evacuation	N/A	N/A	N/A	N/A	N/A	N/A
Float	N/A	N/A	N/A	N/A	N/A	N/A
Total	N/A	N/A	N/A	N/A	N/A	N/A

(CCAs with Unit Cost greater than $500)

	At ELMACO			At ELMACO & LD Unit		
Cost Item	Military	Fed Civilian	Contractor	Military	Fed Civilian	Contractor
Man year	N/A	N/A	N/A	N/A	N/A	N/A
Position	N/A	N/A	N/A	N/A	N/A	N/A
Evacuation	N/A	N/A	N/A	N/A	N/A	N/A
Float	N/A	N/A	N/A	N/A	N/A	N/A
Total	N/A	N/A	N/A	N/A	N/A	N/A

Alternative 3: Cost repair all CCAs

(All CCAs)

	At ELMACO			At ELMACO & LD Unit		
Cost Item	Military	Fed Civilian	Contractor	Military	Fed Civilian	Contractor
Man year	5,352,424	4,555,552	4,524,200	5,352,424	4,640,384	4,627,876
Position	1,194,006	600,000	520,000	1,919,478	1,386,384	1,316,384
Evacuation	42,869,685	42,869,685	42,869,685	42,869,685	42,869,685	42,869,685
Float	13,252,734	13,252,734	13,252,734	13,252,734	13,252,734	13,252,734
Total	62,668,849	61,277,971	61,166,619	63,394,321	62,149,187	62,066,679

(CCAs with greater than 2 Attempted Repairs)

	At ELMACO			At ELMACO & LD Unit		
Cost Item	Military	Fed Civilian	Contractor	Military	Fed Civilian	Contractor
Man year	4,448,768	3,770,112	3,800,328	4,448,768	3,891,072	3,897,408
Position	982,410	500,000	430,000	1,617,198	1,155,244	1,095,244
Evacuation	51,012,265	51,012,265	51,012,265	51,012,265	51,012,265	51,012,265
Float	19,343,798	19,343,798	19,343,798	19,343,798	19,343,798	19,343,798
Total	75,787,241	74,626,175	74,586,391	76,422,029	75,402,379	75,348,715

(CCAs with Unit Cost greater than $500)

	At ELMACO			At ELMACO & LD Unit		
Cost Item	Military	Fed Civilian	Contractor	Military	Fed Civilian	Contractor
Man year	4,587,792	3,927,200	3,890,812	4,587,792	4,012,032	3,994,488
Position	1,027,752	520,000	450,000	1,753,224	1,296,384	1,246,384
Evacuation	43,428,846	43,428,846	43,428,846	43,428,846	43,428,846	43,428,846
Float	13,340,817	13,340,817	13,340,817	13,340,817	13,340,817	13,340,817
Total	62,385,207	61,216,863	61,110,475	63,110,679	62,078,079	62,010,535

Alternative 4: All Comm Elec

(All CCAs)

	At ELMACO			At ELMACO & LD Unit		
Cost Item	Military	Fed Civilian	Contractor	Military	Fed Civilian	Contractor
Man year	4,309,744	3,613,024	3,619,360	4,309,744	3,776,400	3,813,520
Position	952,182	480,000	420,000	1,662,540	1,236,156	1,186,156
Evacuation	55,961,668	55,961,668	55,961,668	55,961,668	55,961,668	55,961,668
Float	14,343,327	14,343,327	14,343,327	14,343,327	14,343,327	14,343,327
Total	75,566,921	74,398,019	74,344,355	76,277,279	75,317,551	75,304,671

(CCAs with greater than 2 Attempted Repairs)

	At ELMACO			At ELMACO & LD Unit		
Cost Item	Military	Fed Civilian	Contractor	Military	Fed Civilian	Contractor
Man year	3,684,136	3,141,760	3,166,940	3,684,136	3,262,720	3,264,020
Position	816,156	410,000	360,000	1,360,260	979,446	929,446
Evacuation	61,758,852	61,758,852	61,758,852	61,758,852	61,758,852	61,758,852
Float	19,551,691	19,551,691	19,551,691	19,551,691	19,551,691	19,551,691
Total	85,810,835	84,862,303	84,837,483	86,354,939	85,552,709	85,504,009

(CCA with Unit Cost greater than $500)

	At ELMACO			At ELMACO & LD Unit		
Cost Item	Military	Fed Civilian	Contractor	Military	Fed Civilian	Contractor
Man year	3,823,160	3,220,304	3,257,424	3,823,160	3,314,168	3,291,588
Position	846,384	430,000	370,000	1,360,260	979,446	929,446
Evacuation	56,314,838	56,314,838	56,314,838	56,314,838	56,314,838	56,314,838
Float	14,424,807	14,424,807	14,424,807	14,424,807	14,424,807	14,424,807
Total	75,409,189	74,389,949	74,367,069	75,923,065	75,033,259	74,960,679

Alternative 5: At least 1 Comm Elec

(All CCAs)

	At ELMACO			At ELMACO & LD Unit		
Cost Item	Military	Fed Civilian	Contractor	Military	Fed Civilian	Contractor
Man year	4,726,816	4,005,744	3,981,296	4,726,816	4,169,120	4,175,456
Position	1,042,866	520,000	460,000	1,783,452	1,326,384	1,256,384
Evacuation	48,892,180	48,892,180	48,892,180	48,892,180	48,892,180	48,892,180
Float	14,343,326	14,343,326	14,343,326	14,343,326	14,343,326	14,343,326
Total	69,005,188	67,761,250	67,676,802	69,745,774	68,731,010	68,667,346

(CCAs with greater than 2 Attempted Repairs)

	At ELMACO			At ELMACO & LD Unit		
Cost Item	Military	Fed Civilian	Contractor	Military	Fed Civilian	Contractor
Man year	4,101,208	3,455,936	3,438,392	4,101,208	3,576,896	3,535,472
Position	906,840	450,000	390,000	1,481,172	1,049,674	989,674
Evacuation	55,223,929	55,223,929	55,223,929	55,223,929	55,223,929	55,223,929
Float	19,551,691	19,551,691	19,551,691	19,551,691	19,551,691	19,551,691
Total	79,783,668	78,681,556	78,604,012	80,358,000	79,402,190	79,300,766

(CCAs with Unit Cost greater than $500)

	At ELMACO			At ELMACO & LD Unit		
Cost Item	Military	Fed Civilian	Contractor	Military	Fed Civilian	Contractor
Man year	4,170,720	3,534,480	3,528,876	4,170,720	3,628,344	3,653,524
Position	937,068	460,000	410,000	1,677,654	1,266,384	1,216,384
Evacuation	49,300,015	49,300,015	49,300,015	49,300,015	49,300,015	49,300,015
Float	14,424,806	14,424,806	14,424,806	14,424,806	14,424,806	14,424,806
Total	68,832,609	67,719,301	67,663,697	69,573,195	68,619,549	68,594,729

Alternative 6: At least 1 MCGERR

(All CCAs)

Cost Item	At ELMACO			At ELMACO & LD Unit		
	Military	Fed Civilian	Contractor	Military	Fed Civilian	Contractor
Man year	4,587,792	3,848,656	3,890,812	4,587,792	3,942,520	3,924,976
Position	1,027,752	510,000	450,000	1,707,882	1,251,042	1,201,042
Evacuation	52,224,996	52,224,996	52,224,996	52,224,996	52,224,996	52,224,996
Float	16,962,374	16,962,374	16,962,374	16,962,374	16,962,374	16,962,374
Total	74,802,914	73,546,026	73,528,182	75,483,044	74,380,932	74,313,388

(CCAs with greater than 2 Attempted Repairs)

Cost Item	At ELMACO			At ELMACO & LD Unit		
	Military	Fed Civilian	Contractor	Military	Fed Civilian	Contractor
Man year	3,753,648	3,220,304	3,166,940	3,753,648	3,341,264	3,264,020
Position	831,270	420,000	370,000	1,450,944	1,019,674	1,005,016
Evacuation	58,782,415	58,782,415	58,782,415	58,782,415	58,782,415	58,782,415
Float	21,261,620	21,261,620	21,261,620	21,261,620	21,261,620	21,261,620
Total	84,628,953	83,684,339	83,580,975	85,248,627	84,404,973	84,313,071

(CCAs with Unit Cost greater than $500)

Cost Item	At ELMACO			At ELMACO & LD Unit		
	Military	Fed Civilian	Contractor	Military	Fed Civilian	Contractor
Man year	3,892,672	3,298,848	3,257,424	3,892,672	3,392,712	3,382,072
Position	861,498	440,000	390,000	1,556,742	1,181,042	1,131,042
Evacuation	52,675,604	52,675,604	52,675,604	52,675,604	52,675,604	52,675,604
Float	17,018,460	17,018,460	17,018,460	17,018,460	17,018,460	17,018,460
Total	74,448,234	73,432,912	73,341,488	75,143,478	74,267,818	74,207,178

APPENDIX B: COST COMPUTATIONS

SECTION 2: REPAIRER MAN-HOUR , MAN-YEAR AND WORKSTATION/ POSITION COMPUTATIONS

	All Repairs At ELMACO			Repairs At ELMACO + LD			LD Repairs at LD Units		
MAN-HRS	ALL CCAs	>2 ATT.REPAIRS	>$500	ALL CCAs	>2 ATT.REPAIRS	>$500	ALL CCAs	>2 ATT.REPAIRS	>$500
ALT1	0	0	0	0	0	0	0	0	0
ALT2	N/A	N/A	N/A	48,939	46,902	45,144	2,995	1,924	2,839
ALT3	100,424	83,253	85,999	100,424	83,253	85,999	10,753	5,114	10,134
ALT4	79,974	69,329	71,232	79,974	69,329	71,232	9,859	4,715	9,314
ALT5	88,964	76,551	78,585	88,964	76,551	78,585	9,964	4,768	9,395
ALT6	85,340	70,478	72,816	85,340	70,478	72,816	9,717	4,689	9,173
MILITARY-MAN-YEAR									
ALT1	0	0	0	0	0	0			
ALT2	N/A	N/A	N/A	39	37	36	2	1	2
ALT3	77	64	66	77	64	66	8	4	8
ALT4	62	53	55	62	53	55	8	4	7
ALT5	68	59	60	68	59	60	8	4	7
ALT6	66	54	56	66	54	56	7	4	7
FED CIVILIAN MAN-YEAR *									
ALT1	0	0	0	0	0	0			
ALT2	N/A	N/A	N/A	27	26	25			
ALT3	58	48	50	52	46	44			
ALT4	46	40	41	41	38	36			
ALT5	51	44	45	46	42	40			
ALT6	49	41	42	44	39	37			
CONTRACTOR MAN- YEAR *									
ALT1	0	0	0	0	0	0			
ALT2	N/A	N/A	N/A	23	23	22			
ALT3	50	42	43	45	40	38			
ALT4	40	35	36	36	33	31			
ALT5	44	38	39	40	36	35			
ALT6	43	35	36	38	33	32			

NUMBER OF TRAINED MILITARY POSITIONS NEEDED									
ALT1	0	0	0	0	0	0	0	0	0
ALT2	N/A	N/A	N/A	85	77	82	48	41	48
ALT3	79	65	68	127	107	116	56	46	56
ALT4	63	54	56	110	90	102	54	39	54
ALT5	69	60	62	118	98	111	56	41	56
ALT6	68	55	57	113	96	103	53	44	53
NUMBER OF TRAINED CIVILIAN POSITIONS NEEDED *									
ALT1	0	0	0	0	0	0			
ALT2	N/A	N/A	N/A	28	27	27			
ALT3	60	50	52	54	46	45			
ALT4	48	41	43	42	39	37			
ALT5	52	45	46	48	43	42			
ALT6	51	42	44	45	40	38			
NUMBER OF TRAINED CONTRACTOR POSITIONS NEEDED *									
ALT1	0	0	0	0	0	0			
ALT2	N/A	N/A	N/A	24	24	23			
ALT3	52	43	45	47	40	40			
ALT4	42	36	37	37	34	32			
ALT5	46	39	41	41	37	37			
ALT6	45	37	39	40	34	33			

Note: Federal Civilian and Contractor repairer man-year & position numbers only reflect GC CCA repairs for the "Repairs at ELMACO + LD Unit" option. Military people repair LD CCAs for this option, so Military LD man-year & position numbers should be used for LD repairs (Third column of this table)

APPENDIX B: COST COMPUTATION

SECTION 3: CCA NSNs, CCA DENSITIES AND CCA FAILURES COMPUTATION

Alternative 1: Evacuate All CCAs

(All CCAs)

	LD (LDFlag = 1)			Ground Common (LD flag = 0)			Grand Total		
	Repairable	Consumable	Total	Repairable	Consumable	Total	Repairable	Consumable	Total
	2,038	613	2,651	2,208	821	3,029	4,246	1,434	5,680
# of CCA NSNs									
No failures:	1,159	453	1,612	1,123	513	1,636	2,282	966	3,248
With failures:	879	160	1,039	1,085	308	1,393	1,964	468	2,432
Total:	2,038	613	2,651	2,208	821	3,029	4,246	1,434	5,680
CAA Failures	2,836.33	247.00	3,083.33	23,126.76	3,004.95	26,131.71	25,963.10	3,251.95	29,215.05
Attempted Repairs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CCA Densities									
No failures:	21,031	6,078	27,109	595,151	342,956	938,107	616,182	349,034	965,216
With failures:	21,337	4,061	25,398	1,156,238	744,129	1,900,367	1,177,575	748,190	1,925,765
Total:	42,368	10,139	52,507	1,751,389	1,087,085	2,838,474	1,793,757	1,097,224	2,890,981
Failures/CCA Densities									
No failures:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
With failures:	0.133	0.061	0.121	0.020	0.004	0.014	0.022	0.004	0.015
Total:	0.067	0.024	0.059	0.013	0.003	0.009	0.014	0.003	0.010

Alternative 2: Status Quo

	LD (LDFlag = 1)			Ground Common (LD flag = 0)			Grand Total		
	Repairable	Consumable	Total	Repairable	Consumable	Total	Repairable	Consumable	Total
	630	16	646	810	44	854	1,440	60	1,500
# of CCA NSNs									
No failures:	0	0	0	0	0	0	0	0	0
With failures:	630	16	646	810	44	854	1,440	60	1,500
Total:	630	16	646	810	44	854	1,440	60	1,500
CAA Failures	2,563.71	81.48	2,645.19	22,552.00	1164.523809	23,716.52	25,115.71	13,672.19	26,361.71
Attempted Repairs	1,039.33	11.00	1,050.33	13,590.71	116.67	13,707.38	14,630.05	127.67	14,757.71
CCA Densities									
No failures:	0	0	0	0	0	0	0	0	0
With failures:	16,496	329	16,825	796,102	55,877	851,979	812,598	56,206	868,804
Total:	16,496	329	16,825	796,102	55,877	851,979	812,598	56,206	868,804
Failures/CCA Densities									
No failures:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
With failures:	0.155	0.248	0.157	0.028	0.243	0.028	0.031	0.243	0.030
Total:	0.155	0.248	0.157	0.028	0.243	0.028	0.031	0.243	0.030

Alternative 3: Cost repair all CCAs

(All CCAs)

	LD (LDFlag = 1)			Ground Common (LD flag = 0)			Grand Total		
	Repairable	Consumable	Total	Repairable	Consumable	Total	Repairable	Consumable	Total
	2,038	613	2,651	2,208	821	3,029	4,246	1,434	5,680
# of CCA NSNs									
No failures:	1,159	453	1,612	1,123	513	1,636	2,282	966	3,248
With failures:	879	160	1,039	1,085	308	1,393	1,964	468	2,432
Total:	2,038	613	2,651	2,208	821	3,029	4,246	1,434	5,680
CAA Failures	2,836.33	247.00	3,083.33	23,126.76	3,004.95	26,131.71	25,963.10	3,251.95	29,215.05
Attempted Repairs	2,836.33	247.00	3,083.33	23,126.76	3,004.95	26,131.71	25,963.10	3,251.95	29,215.05
CCA Densities									
No failures:	21,031	6,078	27,109	595,151	342,956	938,107	616,182	349,034	965,216
With failures:	21,337	4,061	25,398	1,156,238	744,129	1,900,367	1,177,575	748,190	1,925,765
Total:	42,368	10,139	52,507	1,751,389	1,087,085	2,838,474	1,793,757	1,097,224	2,890,981
Failures/CCA Densities									
No failures:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
With failures:	0.133	0.061	0.121	0.020	0.004	0.014	0.022	0.004	0.015
Total:	0.067	0.024	0.059	0.013	0.003	0.009	0.014	0.003	0.010

Alternative 3: Cost repair all CCAs

(CCAs with greater than 2 Attempted Repairs)

	LD (LDFlag = 1)			***Ground Common (LD flag = 0)***			***Grand Total***		
	Repairable	**Consumable**	**Total**	**Repairable**	**Consumable**	**Total**	**Repairable**	**Consumable**	**Total**
	117	0	117	373	9	382	490	9	499
# of CCA NSNs									
No failures:	0	0	0	0	0	0	0	0	0
With failures:	117	0	117	373	9	382	490	9	499
Total:	117	0	117	373	9	382	490	9	499
CAA Failures	1,408.19	0.00	1,408.19	21,402.90	121.00	21,523.90	22,811.10	121.00	22,932.10
Attempted Repairs	1,408.19	0.00	1,408.19	21,402.90	121.00	21,523.90	22,811.10	121.00	22,932.10
CCA Densities									
No failures:	0	0	0	0	0	0	0	0	0
With failures:	4,052	0	4,052	500,584	4,647	505,231	504,636	4,647	509,283
Total:	4,052	0	4,052	500,584	4,647	505,231	504,636	4,647	509,283
Failures/CCA Densities									
No failures:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
With failures:	0.348	0.000	0.348	0.043	0.026	0.043	0.045	0.026	0.045
Total:	0.348	0.000	0.348	0.043	0.026	0.043	0.045	0.026	0.045

Alternative 3: Cost repair all CCAs

(CCAs with Unit Cost greater than $500)

	***LD* (LDFlag = 1)**			***Ground Common* (LD flag = 0)**			***Grand Total***		
	Repairable	**Consumable**	**Total**	**Repairable**	**Consumable**	**Total**	**Repairable**	**Consumable**	**Total**
	1,740	177	1,917	1,627	198	1,825	3,367	375	3,742
# of CCA NSNs									
No failures:	949	115	1,064	822	124	946	1,771	239	2,010
With failures:	791	62	853	805	74	879	1,596	136	1,732
Total:	1,740	177	1,917	1,627	198	1,825	3,367	375	3,742
CAA Failures	2,715.19	148.81	2,864.00	20,658.00	356.95	21,014.95	23,373.19	505.76	23,878.95
Attempted Repairs	2,715.19	148.81	2,864.00	20,658.00	356.95	21,014.95	23,373.19	505.76	23,878.95
CCA Densities									
No failures:	18,206	1,995	20,201	347,013	64,517	411,530	365,219	66,512	431,731
With failures:	19,773	2,235	22,008	666,425	42,694	709,119	686,198	44,929	731,127
Total:	37,979	4,230	42,209	1,013,438	107,211	1,120,649	1,051,417	111,441	1,162,858
Failures/CCA Densities									
No failures:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
With failures:	0.137	0.067	0.130	0.031	0.008	0.030	0.034	0.011	0.033
Total:	0.071	0.035	0.068	0.020	0.003	0.019	0.022	0.005	0.021

Alternative 4: All Comm Elec

(All CCAs)

	LD (LDFlag = 1)			Ground Common (LD flag = 0)			Grand Total		
	Repairable	Consumable	Total	Repairable	Consumable	Total	Repairable	Consumable	Total
	1,878	527	2,405	1,562	550	2,112	3,440	1,077	4,517
# of CCA NSNs									
No failures:	1,046	391	1,437	813	341	1,154	1,859	732	2,591
With failures:	832	136	968	752	210	962	1,584	346	1,930
Total:	1,878	527	2,405	1,565	551	2,116	3,443	1,078	4,521
CAA Failures	2,620.89	186.49	2,807.38	18,571.43	1,370.75	19,942.18	21,192.32	1,557.24	22,749.56
Attempted Repairs	2,620.89	186.49	2,807.38	18,571.43	1,370.75	19,942.18	21,192.32	1,557.24	22,749.56
CCA Densities									
No failures:	15,353	4,982	20,335	370,877	177,287	548,164	386,230	182,269	568,499
With failures:	19,743	2,583	22,326	853,176	456,387	1,309,563	872,919	458,970	1,331,889
Total:	35,096	7,565	42,661	1,224,053	633,674	1,857,727	1,259,149	641,239	1,900,388
Failures/CCA Densities									
No failures:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
With failures:	0.133	0.072	0.126	0.022	0.003	0.015	0.024	0.003	0.017
Total:	0.075	0.025	0.066	0.015	0.002	0.011	0.017	0.002	0.012

Alternative 4: All Comm Elec

(CCAs with greater than 2 Attempted Repairs)

	LD (LDFlag = 1)			Ground Common (LD flag = 0)			Grand Total		
	Repairable	Consumable	Total	Repairable	Consumable	Total	Repairable	Consumable	Total
	110	0	110	272	5	277	382	5	387
# of CCA NSNs									
No failures:	0	0	0	0	1	1	0	1	1
With failures:	110	0	110	272	4	276	382	4	386
Total:	110	0	110	272	5	277	382	5	387
CAA Failures	1,298.63	0.00	1,298.63	17,721.43	52.64	17,774.08	19,020.06	52.64	19,072.70
Attempted Repairs	1,298.63	0.00	1,298.63	17,721.43	52.64	17,774.08	19,020.06	52.64	19,072.70
CCA Densities									
No failures:	0	0	0	0	6	6	0	6	6
With failures:	3,822	0	3,822	395,956	2,897	398,853	399,778	2,897	402,675
Total:	3,822	0	3,822	395,956	2,903	398,859	399,778	2,903	402,681
Failures/CCA Densities									
No failures:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
With failures:	0.340	0.000	0.340	0.045	0.018	0.045	0.048	0.018	0.047
Total:	0.340	0.000	0.340	0.045	0.018	0.045	0.048	0.018	0.047

Alternative 4: All Comm Elec

(CCAs with Unit Cost greater than $500)

	LD (LDFlag = 1)			Ground Common (LD flag = 0)			Grand Total		
	Repairable	Consumable	Total	Repairable	Consumable	Total	Repairable	Consumable	Total
	1,612	144	1,756	1,125	114	1,239	2,737	258	2,995
# of CCA NSNs									
No failures:	866	99	965	586	75	661	1,452	174	1,626
With failures:	746	45	791	539	39	578	1,285	84	1,369
Total:	1,612	144	1,756	1,125	114	1,239	2,737	258	2,995
CAA Failures	2,509.54	109.81	2,619.35	16,915.46	178.81	17,094.28	19,425.00	288.62	19,713.63
Attempted Repairs	2,509.54	109.81	2,619.35	16,915.46	178.81	17,094.28	19,425.00	288.62	19,713.63
CCA Densities									
No failures:	12,776	1,291	14,067	190,698	15,342	206,040	203,474	16,633	220,107
With failures:	18,275	963	19,238	474,931	28,607	503,538	493,206	29,570	522,776
Total:	31,051	2,254	33,305	665,629	43,949	709,578	696,680	46,203	742,883
Failures/CCA Densities									
No failures:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
With failures:	0.137	0.114	0.136	0.036	0.006	0.034	0.039	0.010	0.038
Total:	0.081	0.049	0.079	0.025	0.004	0.024	0.028	0.006	0.027

Alternative 5: At least 1 Comm Elec

(All CCAs)

	***LD** (LDFlag = 1)*			***Ground Common** (LD flag = 0)*			***Grand Total***		
	Repairable	**Consumable**	**Total**	**Repairable**	**Consumable**	**Total**	**Repairable**	**Consumable**	**Total**
	1,878	527	2,405	1,562	550	2,112	3,440	1,077	4,517
# of CCA NSNs									
No failures:	1,046	391	1,437	810	340	1,150	1,856	731	2,587
With failures:	832	136	968	752	210	962	1,584	346	1,930
Total:	1,878	527	2,405	1,562	550	2,112	3,440	1,077	4,517
CAA Failures									
	2,649.67	186.67	2,836.33	20,813.24	1,768.76	22,582.00	23,462.90	1,955.43	25,418.33
Attempted Repairs									
	2,649.67	186.67	2,836.33	20,813.24	1,768.76	22,582.00	23,462.90	1,955.43	25,418.33
CCA Densities									
No failures:	15,441	5,014	20,455	555,276	265,222	820,498	570,717	270,236	840,953
With failures:	19,967	2,591	22,558	1,082,416	709,439	1,791,855	1,102,383	712,030	1,814,413
Total:	35,408	7,605	43,013	1,637,692	974,661	2,612,353	1,673,100	982,266	2,655,366
Failures/CCA Densities									
No failures:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
With failures:	0.133	0.072	0.126	0.019	0.002	0.013	0.021	0.003	0.014
Total:	0.075	0.025	0.066	0.013	0.002	0.009	0.014	0.002	0.010

Alternative 5: At least 1 Comm Elec

(CCAs with greater than 2 Attempted Repairs)

	LD (LDFlag = 1)			Ground Common (LD flag = 0)			Grand Total		
	Repairable	Consumable	Total	Repairable	Consumable	Total	Repairable	Consumable	Total
	110	0	110	272	5	277	382	5	387
# of CCA NSNs									
No failures:	0	0	0	0	0	0	0	0	0
With failures:	110	0	110	272	5	277	382	5	387
Total:	110	0	110	272	5	277	382	5	387
CAA Failures	1,313.19	0.00	1,313.19	19,681.00	72.67	19,753.67	20,994.19	72.67	21,066.86
Attempted Repairs	1,313.19	0.00	1,313.19	19,681.00	72.67	19,753.67	20,994.19	72.67	21,066.86
CCA Densities									
No failures:	0	0	0	0	0	0	0	0	0
With failures:	3,854	0	3,854	470,835	3,690	474,525	474,689	3,690	478,379
Total:	3,854	0	3,854	470,835	3,690	474,525	474,689	3,690	478,379
Failures/CCA Densities									
No failures:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
With failures:	0.341	0.000	0.341	0.042	0.020	0.042	0.044	0.020	0.044
Total:	0.341	0.000	0.341	0.042	0.020	0.042	0.044	0.020	0.044

Alternative 5: At least 1 Comm Elec

(CCAs with Unit Cost greater than $500)

	LD (LDFlag = 1)			Ground Common (LD flag = 0)			Grand Total		
	Repairable	Consumable	Total	Repairable	Consumable	Total	Repairable	Consumable	Total
	1,612	144	1,756	1,125	114	1,239	2,737	258	2,995
# of CCA NSNs									
No failures:	866	99	965	584	75	659	1,450	174	1,624
With failures:	746	45	791	541	39	580	1,287	84	1,371
Total:	1,612	144	1,756	1,125	114	1,239	2,737	258	2,995
CAA Failures	2,531.86	109.81	2,641.67	18,885.19	234.86	19,120.05	21,417.05	344.67	21,761.71
Attempted Repairs	2,531.86	109.81	2,641.67	18,885.19	234.86	19,120.05	21,417.05	344.67	21,761.71
CCA Densities									
No failures:	12,856	1,299	14,155	318,559	34,022	352,581	331,415	35,321	366,736
With failures:	18,419	963	19,382	616,597	34,374	650,971	635,016	35,337	670,353
Total:	31,275	2,262	33,537	935,156	68,396	1,003,552	966,431	70,658	1,037,089
Failures/CCA Densities									
No failures:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
With failures:	0.137	0.000	0.136	0.031	0.007	0.029	0.034	0.010	0.032
Total:	0.081	0.000	0.079	0.020	0.003	0.019	0.022	0.005	0.021

Alternative 6: At least 1 MCGERR

(All CCAs)

	LD (LDFlag = 1)			Ground Common (LD flag = 0)			Grand Total		
	Repairable	Consumable	Total	Repairable	Consumable	Total	Repairable	Consumable	Total
	1,792	492	2,284	1,601	562	2,163	3,393	1,054	4,447
# of CCA NSNs									
No failures:	1,002	354	1,356	702	307	1009	1,704	661	2,365
With failures:	790	138	928	899	255	1154	1,689	393	2,082
Total:	1,792	492	2,284	1,601	562	2,163	3,393	1,054	4,447
CAA Failures	2,577.76	183.62	2,761.38	19,496.52	2,557.86	22,054.38	22,074.29	2,741.48	24,815.76
Attempted Repairs	2,577.76	183.62	2,761.38	19,496.52	2,557.86	22,054.38	22,074.29	2,741.48	24,815.76
CCA Densities									
No failures:	19,605	5,146	24,751	520,800	286,839	807,639	540,405	291,985	832,390
With failures:	20,369	3,865	24,234	1,101,484	722,240	1,823,724	1,121,853	726,105	1,847,958
Total:	39,974	9,011	48,985	1,622,284	1,009,079	2,631,363	1,662,258	1,018,090	2,680,348
Failures/CCA Densities									
No failures:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
With failures:	0.127	0.048	0.114	0.018	0.004	0.012	0.020	0.004	0.013
Total:	0.064	0.020	0.056	0.012	0.003	0.008	0.013	0.003	0.009

Alternative 6: At least 1 MCGERR

(CCAs with greater than 2 Attempted Repairs)

	LD (LDFlag = 1)			Ground Common (LD flag = 0)			Grand Total		
	Repairable	Consumable	Total	Repairable	Consumable	Total	Repairable	Consumable	Total
	101	0	101	324	7	331	425	7	432
# of CCA NSNs									
No failures:	0	0	0	0	0	0	0	0	0
With failures:	101	0	101	324	7	331	425	7	432
Total:	101	0	101	324	7	331	425	7	432
CAA Failures	1,288.19	0.00	1,288.19	18,037.62	72.33	18,109.95	19,325.81	72.33	19,398.14
Attempted Repairs	1,288.19	0.00	1,288.19	18,037.62	72.33	18,109.95	19,325.81	72.33	19,398.14
CCA Densities									
No failures:	0	0	0	0	0	0	0	0	0
With failures:	3,820	0	3,820	479,121	1,936	481,057	482,941	1,936	484,877
Total:	3,820	0	3,820	479,121	1,936	481,057	482,941	1,936	484,877
Failures/CCA Densities									
No failures:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
With failures:	0.337	0.000	0.337	0.038	0.037	0.038	0.040	0.037	0.040
Total:	0.337	0.000	0.337	0.038	0.037	0.038	0.040	0.037	0.040

Alternative 6: At least 1 MCGERR

(CCAs with Unit Cost greater than $500)

	LD (LDFlag = 1)			Ground Common (LD flag = 0)			Grand Total		
	Repairable	Consumable	Total	Repairable	Consumable	Total	Repairable	Consumable	Total
	1,542	146	1,688	1,149	137	1,286	2,691	283	2,974
# of CCA NSNs									
No failures:	834	95	929	500	78	578	1,334	173	1,507
With failures:	708	51	759	649	59	708	1,357	110	1,467
Total:	1,542	146	1,688	1,149	137	1,286	2,691	283	2,974
CAA Failures	2,463.62	112.81	2,576.43	17,346.57	275.81	17,622.38	19,810.19	388.62	20,198.81
Attempted Repairs	2,463.62	112.81	2,576.43	17,346.57	275.81	17,622.38	19,810.19	388.62	20,198.81
CCA Densities									
No failures:	17,222	1,845	19,067	312,057	58,918	370,975	329,279	60,763	390,042
With failures:	18,897	2,120	21,017	622,391	36,474	658,865	641,288	38,594	679,882
Total:	36,119	3,965	40,084	934,448	95,392	1,029,840	970,567	99,357	1,069,924
Failures/CCA Densities									
No failures:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
With failures:	0.130	0.053	0.123	0.028	0.008	0.027	0.031	0.010	0.030
Total:	0.068	0.028	0.064	0.019	0.003	0.017	0.020	0.004	0.019

Distribution list

Annotated Briefing 99-116

SNDL

A6	HQMC C4I	
	Attn:	LTCOL P. CYR
MCCDC	CG MCCDC	
	Attn:	MR DICK VOLTZ
	Attn:	MAJ DAVE KUNZMAN
V28	COMMARCORSYSCOM QUANTICO VA	
	Attn:	LTCOL JULIANO
	Attn:	MR JOHN FINKE
	Attn:	MR MIKE HEILMAN